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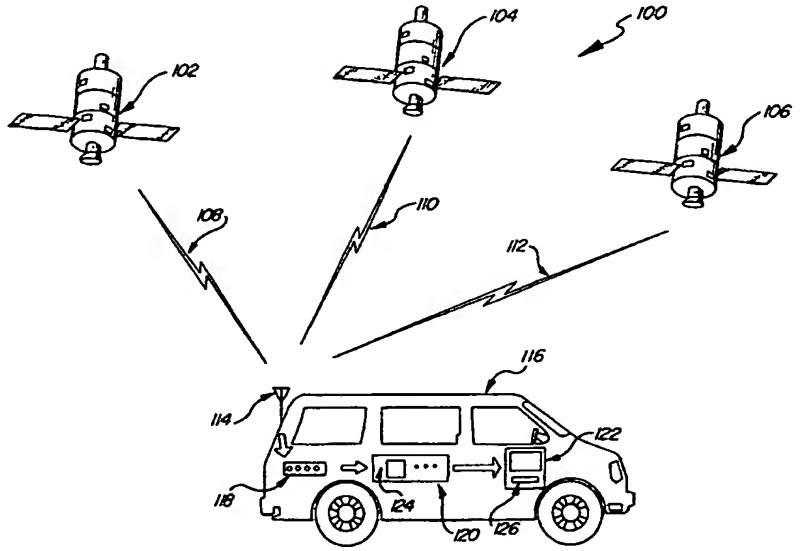
(54) Title: IN-VEHICLE SCREEN BLANKING USING GLOBAL POSITIONING SYSTEM (GPS) SPEED DATA



(57) Abstract

A method and apparatus for automatically blanking an in-vehicle screen (122) disposed within a vehicle (116), when the speed of the vehicle (116) exceeds a predetermined speed. The screen (122) is restored to display visual information after the screen (122) is blanked when the speed of the vehicle (116) reaches back to lessthan the predetermined speed. The speed of the vehicle (116) is determined from position indicating signals sent by Global Positioning System (GPS) satellites (103, 104, and 106). Determining the speed of the vehicle from GPS position indicating signals can preclude non-compliance with federal or local regulations of commercial carrier vehicles that require in-vehicle screens to be blanked when the speed of the vehicle exceeds the predetermined speed.

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IN-VEHICLE SCREEN BLANKING USING GLOBAL POSITIONING SYSTEM (GPS) SPEED DATA

Field of the Invention

The present invention relates generally to in-vehicle travel information display systems, and more particularly to a method and apparatus for blanking in-vehicle display screens when the vehicle speed exceeds a predetermined speed, where the vehicle speed is determined from position indicating signals provided by a Global Positioning System (GPS).

Background

In-vehicle travel information display systems, such as navigation guides, are becoming more commonly incorporated into vehicles. Such systems typically direct a driver of a vehicle through an efficient path of travel from a source location to a destination location.

These systems are especially beneficial to drivers of commercial carrier vehicles, such as Federal Express or United Parcel Service delivery trucks, since these drivers typically must travel from a wide variety of source locations to a wide variety of destination locations in a day. Many commercial carriers install display systems in their vehicles for a variety of purposes.

Commercial carrier vehicles typically operate under federal and in some cases local regulations which require that display screens within these vehicles be blanked when these vehicles are in motion or are traveling above a predetermined speed. To aid compliance with such regulations, U. S. Patent No. 5,148,153 to Haymond shows a travel information system that automatically blanks the display screen and deactivates the input keyboard when the vehicle is detected to be in motion.

In that prior art system, a motion sensor determines whether the vehicle is in motion. The motion sensor in that system can be implemented by either counting the revolutions of the speedometer cable or wheel revolutions, or by interfacing directly

with the transmission of the vehicle. A problem with the use of such a motion sensor of the prior art is that the driver of the vehicle can forgo compliance by cutting the wiring from the speedometer cable or from the transmission of the vehicle to the navigation system. Drivers of commercial carrier vehicles may forgo the inconvenience of screen blanking by cutting this wiring.

U.S. Patent No. 5,179,519 to Adachi et al. teaches the use of GPS position indicating data by a vehicle for determining the speed of the vehicle.

An in-vehicle screen blanking system that would preclude non-compliance with federal and local regulations of commercial carriers would be desirable.

Objects of the Invention

Accordingly, a primary object of the present invention is to provide a method and apparatus for blanking in-vehicle display screens when the vehicle speed exceeds a predetermined speed, wherein the driver cannot easily tamper with that method and apparatus.

In particular, an object of the present invention is to determine the speed of the vehicle from Global Positioning System (GPS) position indicating signals in order to blank the in-vehicle display screen when the vehicle speed exceeds a predetermined speed.

Summary

In a general aspect of the present invention, an in-vehicle screen blanking system automatically blanks an in-vehicle screen disposed within a vehicle when the speed of the vehicle exceeds a predetermined speed. In this in-vehicle screen blanking system, a GPS receiver receives position indicating signals from a Global Positioning System (GPS) to determine the speed of the vehicle from the position indicating signals. A data processor compares the speed of the vehicle determined from the GPS data to the predetermined speed to blank the in-vehicle screen when the speed of the vehicle is greater than the predetermined speed.

In a related aspect of the present invention, the in-vehicle screen is restored back to display travel guide information after the screen has been blanked if the speed of the vehicle is less than the predetermined speed.

In a further aspect of the present invention, the data processor includes a speech synthesizer to generate a synthesized audio format of corresponding information to be displayed on the screen, when the screen is blanked.

These and other features and advantages of the present invention will be better understood by considering the following detailed description of the invention which is presented with the attached drawings.

Brief Description of the Drawings

Fig. 1 shows a diagram of an in-vehicle screen blanking system of the present invention;

Fig. 2 shows a block diagram of an example travel guide information display system;

Fig. 3 shows a block diagram of a system for transmitting messages of travel guide information to be displayed by the in-vehicle display system of Fig. 2;

Fig. 4 shows a format for the messages transmitted by the message transmitting system of Fig. 3;

Fig. 5 shows the designation of links and sublinks for each location on a map;

Fig. 6 shows the assignment of coverage zones to each message transmitting system of Fig. 3; and

Fig. 7 shows a flowchart illustrating the steps of operation of the in-vehicle screen blanking system of the present invention.

Detailed Description of the Preferred Embodiment

Fig. 1 illustrates an in-vehicle screen blanking system 100 according to a preferred embodiment of the present invention. A typical configuration for Global Positioning System (GPS) signal reception comprises at least three GPS satellites for

sending position indicating signals that determine the position of the vehicle. The GPS configuration in Fig. 1 is comprised of a first GPS satellite 102, a second GPS satellite 104, and a third GPS satellite 106.

The first GPS satellite 102 sends a first position indicating signal 108, the second GPS satellite 104 sends a second position indicating signal 110, and the third satellite 106 sends a third position indicating signal 112. These position indicating signals are detected by a GPS signal receiving antenna 114 of a vehicle 116 and are sent to a GPS receiver 118 on the vehicle 116. The GPS receiver is operatively coupled to a data processor 120 which may include a speech synthesizer 124, and the data processor is operatively coupled to an in-vehicle display screen 122 which may include a speaker 126.

The display screen 122 may be part of a travel guide information system. An example travel guide information system is an in-vehicle sign display system. This system displays on the screen 122 typical road signs. Such road signs can include approaching intersection signs such as the typical freeway exit sign near a highway intersection, or a "Road Construction Ahead" sign, or a sign for a rest stop, or a sign warning of an accident or traffic ahead, or a sign for commercial advertisement. Each of these signs automatically pops up on the in-vehicle display screen when the vehicle is at a location corresponding to a particular sign. For example, a sign for a freeway exit pops up on the screen when the vehicle is approaching the highway intersection for that freeway exit. In this manner, the driver of the commercial carrier vehicle may quickly verify that the vehicle is following the correct route, among other advantages of the present invention.

Fig. 2 shows a block diagram of such a travel guide information system 200 which is disposed within a vehicle. This system includes a message receiving antenna 202, operatively coupled to a message receiver 204. A GPS antenna 205 is operatively connected to a location determining system 206, which determines the location of the vehicle from the GPS position indicating signals sent by the GPS satellites as in Fig. 1 and detected by the GPS antenna. The message receiver 204

and the location determining system 206 are operatively coupled to a processor 208 which is operatively coupled to an in-vehicle display 210.

Fig. 3 shows a block diagram of a system 300 for transmitting a message that includes the sign to be displayed by the travel guide information system 200 of Fig. 2. This transmitting system includes a message entry module 302 operatively coupled to a message encoding module 304 operatively coupled to a transmitter 306. A message transmitting antenna 308, operatively coupled to the transmitter 306, sends out the messages to be received by the message receiving antenna 202 in Fig. 2.

The operation of this travel guide information system 200 is now described. The message which is sent out via the message sending antenna 308 of Fig. 3 and which is received via the message receiving antenna 202 of Fig. 2 is in a transmitted message format 400 as illustrated in Fig. 4. This message format is comprised of multiple message fields for each message. A first message field 402 contains a "start of message" word to indicate a start of the message. A second message field 404 contains a location and in some cases the direction of the vehicle where the corresponding sign of this message should be displayed on the in-vehicle screen of that vehicle. A third message field 406 contains sign data which determines the content of the sign to be displayed on the in-vehicle screen. Finally, a fourth message field 408 contains an "end of message" word to indicate an end of the message.

Sign data for the sign data field 406 and the corresponding location and direction for the location field 404 for a message is entered at the message entry module 302 in Fig. 3. That information is put into the message format 400 of Fig. 4 at the message encoding module 304. The transmitter 306 transmits messages in that message format via the message transmitting antenna 308.

The location field 404 can specify both the location and direction of the vehicle. The sign data within the corresponding sign data field 406 is displayed when the vehicle is at that location and is travelling toward that direction. The

location and direction data within the location field may be expressed in terms of latitude and longitude. Additionally, this data may be expressed in terms of a link ID field 410 and a sublink ID field 412 as shown in Fig. 4.

The assignment of links and sublinks for location and direction is illustrated in Fig. 5. A link is typically a length of a road for one direction between road intersections. For example in Fig. 5, a first link 502 is the southbound length of a road between a first road intersection 504 and a second road intersection 506. The first link 502 consists of multiple sublinks. An example of a first sublink 508 is shown in Fig. 5 in the middle of the first link 502. A second link 510 is the northbound length of a road between the first and second road intersections. The second link 510 also consists of multiple sublinks. An example sublink 512 is shown in Fig. 5 in the middle of the second link 510. By specifying a link and a sublink, a location and a direction of a vehicle can thus be specified.

In the operation of the travel guide information system 200 of Fig. 2, the message receiving antenna 202 receives a series of messages that have been sent by the message transmitting antenna 308. The message receiver 204 stores these messages. The location determining system 206 determines the actual location and direction of the vehicle from GPS position indicating signals detected by the GPS antenna 205 from the GPS satellites. The message received by the message receiving antenna 202 is in the message format 400 of Fig. 4. The processor 208 compares the location and direction field 404 of the message with the actual location and direction of the vehicle, and if they are substantially similar, then the processor 208 sends the sign data from the sign data field 406 of the message to be displayed on the display screen 210.

Once the sign data of a message is displayed, this message is cleared from storage in the message receiver 204. If the sign data of a message is not displayed, this message is stored in the message receiver 204 until the vehicle enters the location and direction specified for that message or until a predetermined period of time, whichever is sooner. Thus, if a sign for a message stored within a message

receiver 204 is not displayed for the predetermined period of time, then that message can be deemed to be "stale." The probability that a stale message will be displayed is low since a stale message typically indicates that a vehicle is moving away from the location specified in the location field of that message. Thus, once a message becomes stale, that message is cleared out of storage within the message receiver 204.

Multiple instances of the message transmitter 306 may be provided to cover a wide geographical area. Each transmitter may be assigned to a respective geographical coverage zone as illustrated in Fig. 6. For example, a first transmitter 602 is assigned to a first coverage zone 604, a second transmitter 606 is assigned to a second coverage zone 608, and a third transmitter 610 is assigned to a third coverage zone 612. A coverage zone is the geographic area in which a vehicle within that zone should "listen" to the respective transmitter assigned to that coverage zone. Thus, messages transmitted within a coverage zone contain sign data corresponding to a location within that coverage zone.

Transmitters in close proximity to each other are assigned different frequencies. The processor 208 in Fig. 2 is given a file that indicates the respective radio frequency for each coverage zone. When the vehicle enters a coverage zone, the processor 208 tunes the message receiver 204 to the respective radio frequency of that coverage zone.

In this manner, a vehicle receives messages for display on a real time basis as the vehicle enters different coverage zones. Then a sign contained within a message is displayed as soon as the vehicle is substantially near the location specified within the message containing that sign.

Fig. 7 shows the steps that are performed during operation of the in-vehicle screen blanking system 100 of Fig. 1. Referring to Figs. 1 and 7, upon receiving the GPS position indicating signals 108, 110, 112, via the GPS signal receiving antenna 114, the GPS receiver 118 determines the vehicle speed of the vehicle 116 from the

GPS position indicating signals.

As shown in Fig. 7, the data processor 120 reads the vehicle speed from the GPS receiver 118 at step 702. The data processor then determines if the in-vehicle display screen 122 is already blanked in step 704. In the case the screen is already blanked, the vehicle speed is compared with a predetermined speed which is the threshold speed when the display screen 122 should be blanked at step 706. The threshold speed may be determined by federal or local regulations of commercial carrier vehicles, and can be zero. The threshold speed can be programed into the data processor or a user can enter in this threshold speed. In the case a user can vary the threshold speed, the user may have to prove access to vary this speed by entering in a password. A password verification prevents non-compliance by drivers of commercial carriers by precluding the drivers' ability to change the threshold speed.

In the case the vehicle speed is greater than the predetermined speed, the display screen is blanked at step 708. Any visual images displayed on the screen 210 is blanked out. If the display screen is blanked, then the speech synthesizer 124 can be used to present the message to be displayed on the display screen in an audio format. The data processor 120 of Fig. 1 can include that speech synthesizer 124, and the display 122 can include the speaker 126 for presenting the sign data in that audio format. If the vehicle speed is not greater than (or not greater than or equal to) the predetermined speed, then the display screen is kept on, and the data processor goes back to step 702 to recheck the speed of the vehicle such that the speed of the vehicle can be rechecked periodically.

If at step 704, the screen is already blanked, then it may be assumed that in a prior time period the vehicle speed exceeded the predetermined speed. In that case, the vehicle speed is again compared with the predetermined speed in a current time period at step 710. In the case the vehicle speed has returned to being less than (or less than or equal to) the predetermined speed, the display screen is restored to display the signs at step 712. If the vehicle speed is not less than (or not less than or equal to) the predetermined speed, then the display screen is kept off, and the data

processor goes back to step 702 to recheck the speed of the vehicle.

In any case, the speed of the vehicle is rechecked by returning to step 702. In this manner, the speed of the vehicle is monitored every predetermined time period, and the condition of the in-vehicle display screen is updated every predetermined time period. In an alternative embodiment, the time period between each comparison of the vehicle speed to the predetermined speed can be varied with the speed of the vehicle. For example, when the speed of the vehicle is higher, than the comparison of the vehicle speed to the predetermined speed can be less frequent since the probability that the speed of the vehicle will fall below the predetermined threshold speed within a short time period is lower.

With the in-vehicle screen blanking system of the present invention, the in-vehicle display screen is blanked when the vehicle speed is above (or above or equal to) a predetermined speed. Once blanked, the display screen is restored to a displaying mode if the vehicle speed falls back to below the predetermined speed. The vehicle speed is determined from position indicating signals from GPS satellites. With this means of determining vehicle speed, non-compliance with federal or local regulations that require blanking of in-vehicle display screens when the vehicle speed exceeds a threshold is made more difficult.

The forgoing description is by way of example only and is not intended to be limiting. For example, the in-vehicle screen blanking system can be used in conjunction with any in-vehicle display screen and not only display screens for displaying typical road signs along the locations of a vehicle. Any patents referred to herein should be deemed to be incorporated by reference as to any subject matter deemed essential to a proper understanding of the present invention, for example, the known operations of the Global Positioning System. The invention is limited only as defined in the following claims and equivalents thereof.

CLAIMS

What is claimed is:

1. A method for automatically blanking an in-vehicle screen disposed within a vehicle, the method including in combination, the steps of:

a) receiving position indicating signals for said vehicle from a Global Positioning System (GPS);

b) determining a speed of said vehicle from said position indicating signals; and

c) blanking said screen when said speed is greater than a predetermined speed.

2. The method of claim 1, further including the step of:

d) restoring said screen after said step of blanking when said speed is less than said predetermined speed.

3. The method of claim 2, further including the step of:

e) repeating steps a-d every predetermined time period.

4. The method of claim 2, further including the step of:

f) repeating steps a-d after a time period, wherein said time period increases with an increase in said vehicle speed.

5. The method of claim 1, further including the step of:

g) generating a synthesized audio format of corresponding sign information to be displayed on said screen.

6. The method of claim 1, further including the step of:

h) providing a synthesized audio format of corresponding sign information to be displayed on said screen, when said screen is blanked.

7. The method of claim 1, wherein said in-vehicle screen displays road signs, said method further including the step of:

i) displaying each road sign only at a respective location of said vehicle for each road sign.

8. An in-vehicle screen blanking system for automatically blanking an in-vehicle screen disposed within a vehicle, said system comprising, in combination:

a GPS receiver for receiving position indicating signals for said vehicle from a Global Positioning System (GPS) and for determining a speed of said vehicle from said position indicating signals; and

a data processor, operatively connected to said GPS receiver and said screen, for comparing said speed of said vehicle with a predetermined speed to blank said screen when said speed is greater than said predetermined speed.

9. The screen blanking system of claim 8, the data processor further including a speech synthesizer for generating a synthesized audio format of corresponding information to be displayed on said screen.

10. The screen blanking system of claim 9, wherein said synthesized audio format is provided instead of a display on said screen, when said screen is blanked.

11. The screen blanking system of claim 8, wherein said data processor restores said screen after said blanking, when said speed is less than said predetermined speed.

12. The screen blanking system of claim 8 wherein said in-vehicle screen displays road signs, and wherein, said data processor controls each road sign to be displayed only at a respective location of said vehicle for each sign.

13. An in-vehicle sign display system having a screen blanking system for automatically blanking an in-vehicle screen disposed within a vehicle, said display system comprising, in combination:

a display screen for displaying road signs within said vehicle, each road sign being displayed when said vehicle is at a respective location for each road sign;

a message transmitting system for transmitting road sign messages, each road sign message comprising data for a respective road sign and comprising a respective vehicle location for said respective road sign;

a message receiving antenna for detecting said road sign messages sent by said message transmitting system;

a message receiver, operatively connected to said message receiving antenna, for receiving and storing said road sign messages detected by said message receiving antenna;

a GPS antenna for detecting position indicating signals sent by a Global Positioning System (GPS) for said vehicle;

a GPS receiver, operatively connected to said GPS antenna, for receiving said position indicating signals detected by said GPS antenna for said vehicle and for determining a location and a speed of said vehicle from said position indicating signals; and

a data processor, operatively connected to said message receiver, said GPS receiver, and said display screen, for comparing said speed of said vehicle with a predetermined speed to blank said screen when said speed is greater than said predetermined speed, and for comparing said location of said vehicle with said respective vehicle location contained in each road sign message received by said message receiving antenna to control said screen to display a respective road sign contained within each message when said location of said vehicle is substantially similar to said respective vehicle

location specified for said respective road sign for each message.

14. The in-vehicle sign display system of claim 13, the data processor further including a speech synthesizer for generating a synthesized audio format of corresponding information to be displayed on said screen.

15. The in-vehicle sign display system of claim 14, wherein said synthesized audio format is provided instead of a display on said screen, when said screen is blanked.

16. The in-vehicle sign display system of claim 13, wherein said data processor restores said screen after said blanking, when said speed is less than said predetermined speed.

17. The in-vehicle sign display system of claim 13, wherein said message transmitting system further includes:

a message entry module for inputting data for said road sign messages;

a message encoding module for encoding said data for said road sign messages into a transmitted message format; and

a transmitter for transmitting said road sign messages in said transmitted message format.

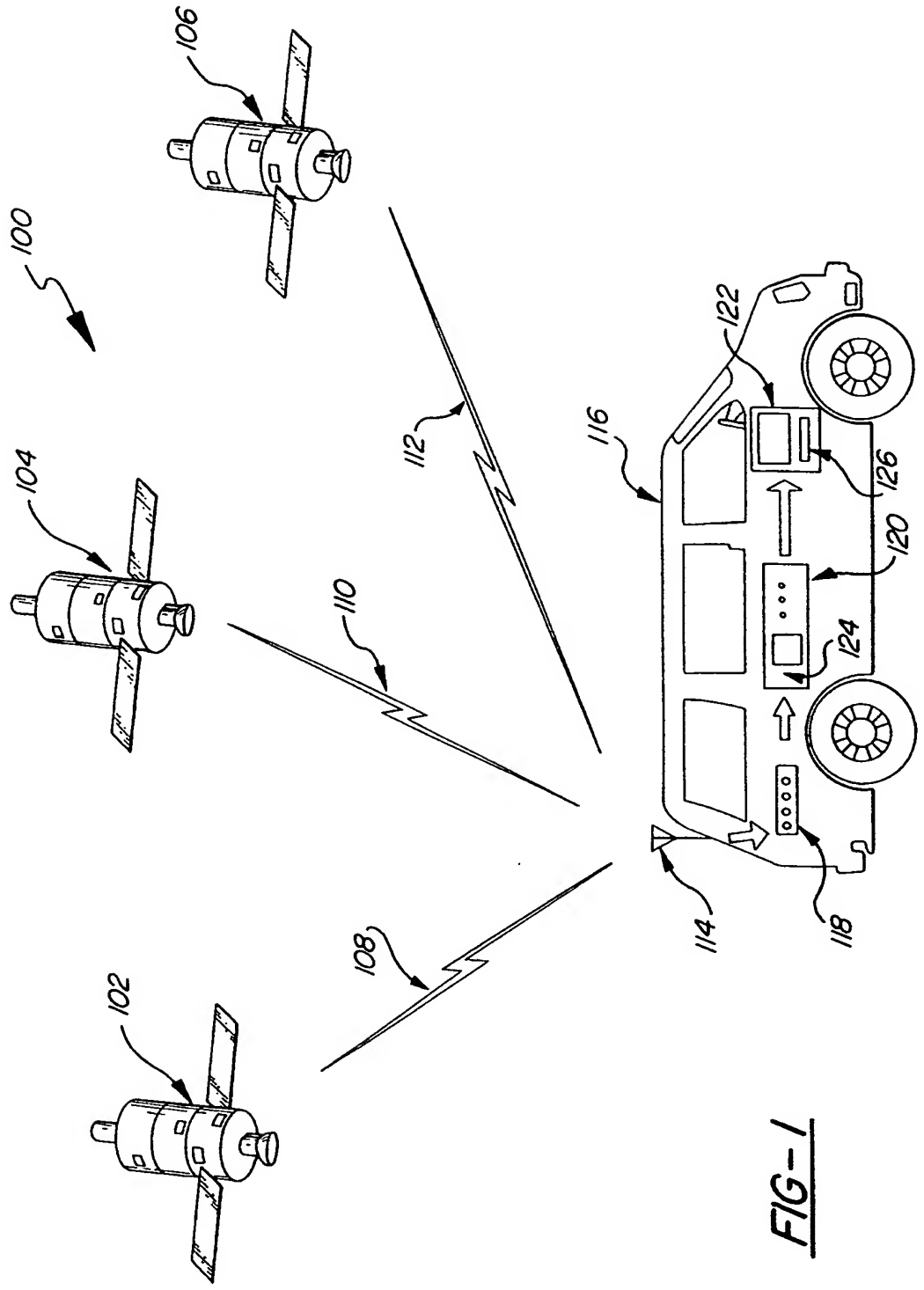


FIG-1

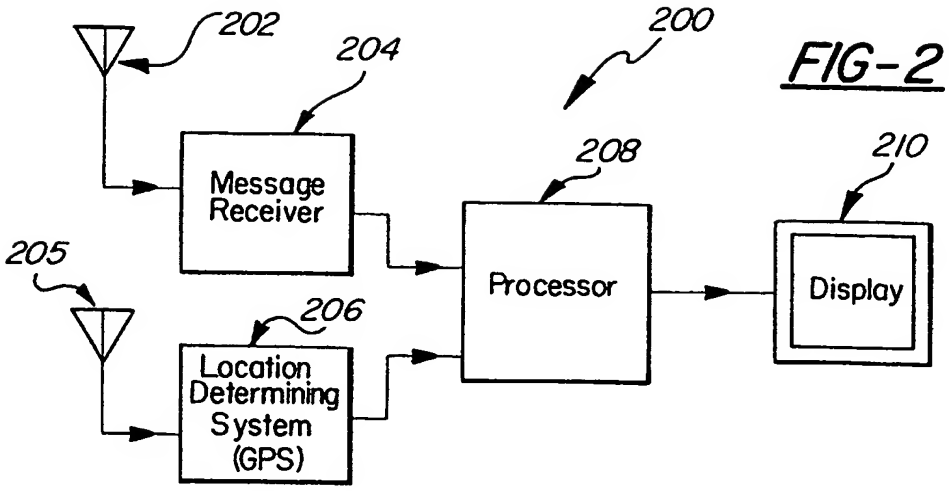


FIG-2

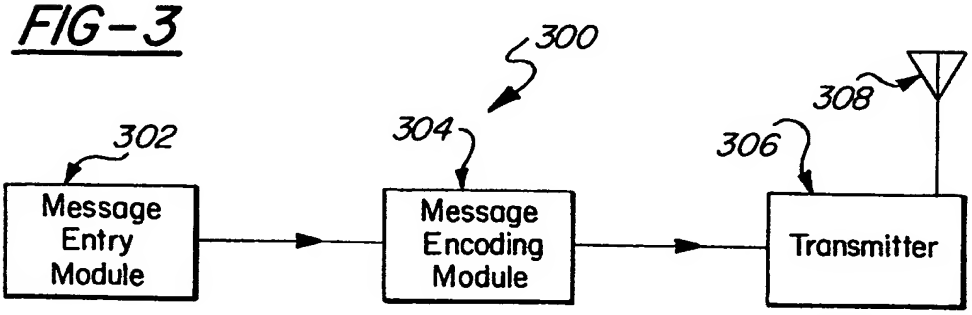


FIG-3

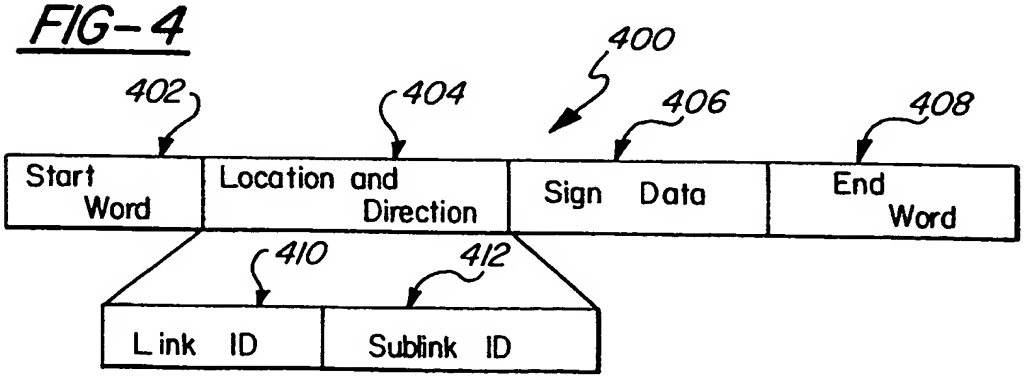
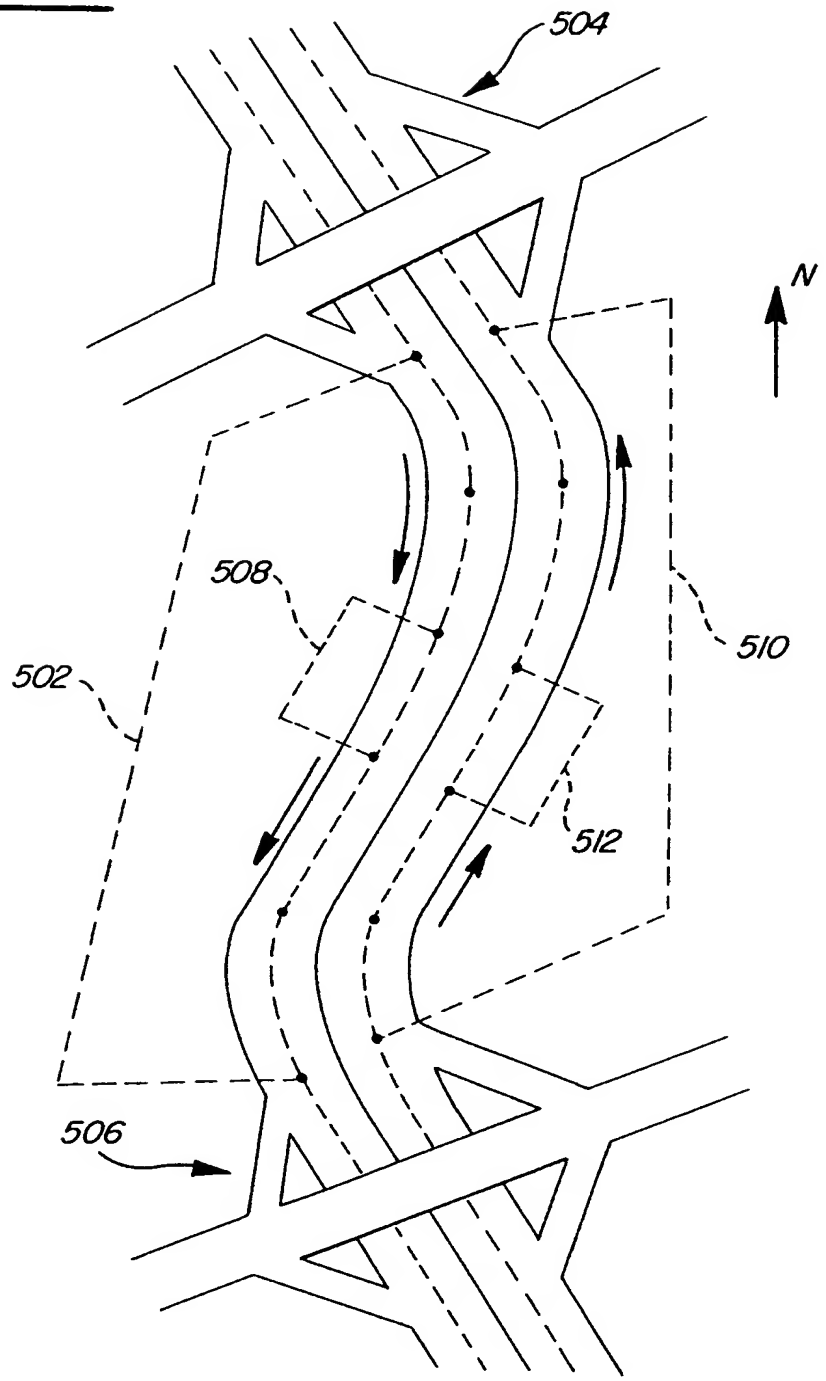


FIG-4

FIG-5



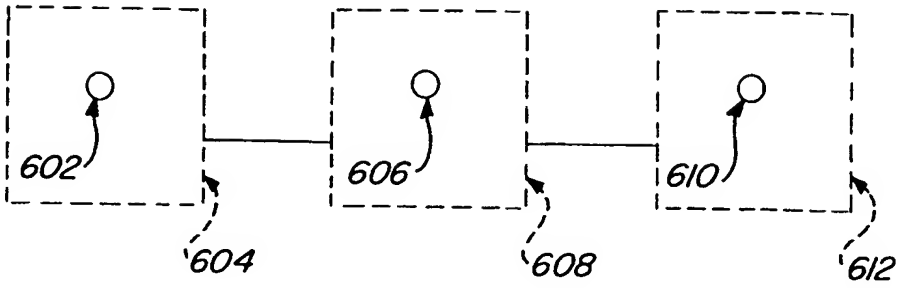

602
604
606
608
610
612

FIG-6

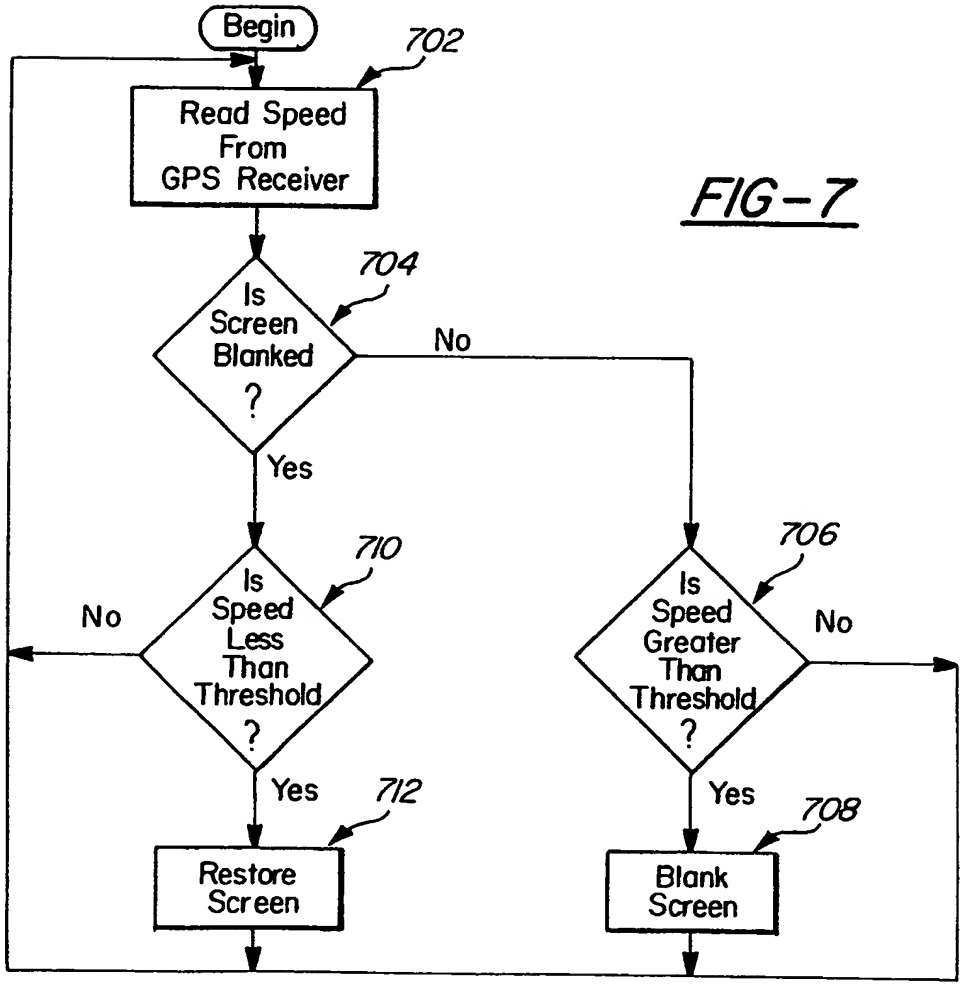

Begin
702
Read Speed From GPS Receiver
704
Is Screen Blanked ?
No
Yes
710
Is Speed Less Than Threshold ?
No
Yes
712
Restore Screen
706
Is Speed Greater Than Threshold ?
No
Yes
708
Blank Screen

FIG-7

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US98/05737

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) :G06F 165/00; G01S 5/02; G08G 1/0967, 1/0969, 1/123

US CL :Please See Extra Sheet.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 701/93, 96, 117, 119, 121, 213, 300; 340/ 904, 905, 936, 990, 992, 995, 438, 435, 441, 461, 466; 342/357, 457

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

NONE

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

APS

search terms: GPS, speed, violation, display screen, blank

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5,179,519 A (ADACHI et al) 12 June 1993 (12.06.93, figures 1,2 and 4.	1-6, 8-11
Y	US 5,148,153 A (HAYMOND) 15 September 1992 (15.09.92), abstract, figures 3 and 5.	1-6, 8-11
Y	US 4,357,593 A (TOMKEWITSCH) 02 November 1982 (02.11.82), figures 1 and 4.	7, 12-17
A	US 5,485,161 A (VAUGHN) 16 January 1996 (16.01.96), abstract and figures 1-4.	1-17
A	US 4,591,823 A (HORVAT) 27 May 1986 (27.05.86), abstract and figures 1-3.	1-17
A	US 5,257,023 A (FURUYA) 26 October 1993 (26.10.93), abstract.	1-17

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

*	Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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Date of the actual completion of the international search 16 JUNE 1998	Date of mailing of the international search report 13 JUL 1998
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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US98/05737

A. CLASSIFICATION OF SUBJECT MATTER:
US CL :

701/93, 96, 117, 119, 121, 213, 300; 340/ 904, 905, 936, 990, 992, 995, 438, 435, 441, 461, 466; 342/357, 457